

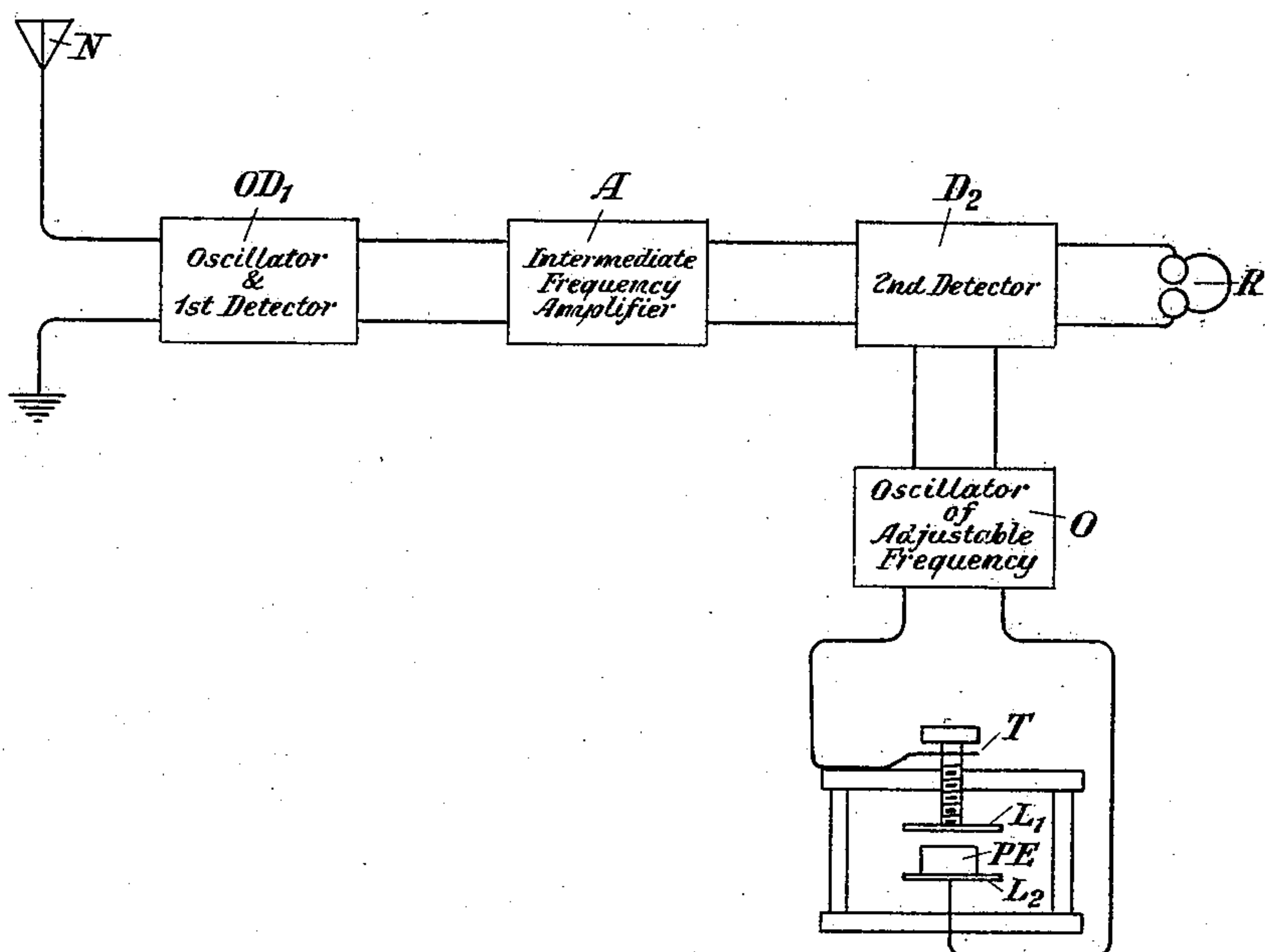
April 8, 1930.

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1,753,446

SIGNALING SYSTEM

Filed Oct. 8, 1926



BY

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UNITED STATES PATENT OFFICE

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SIGNALING SYSTEM

Application filed October 8, 1926. Serial No. 140,389.

This invention relates to signaling systems, and particularly to arrangements in such systems for faithfully reproducing original low frequency signals from corresponding bands of signals of high frequency.

It is well known that in order to attain good voice quality in voice frequency signaling systems when transmitting voice frequency signals in the form of high frequency energy over a considerable distance, it is necessary to maintain the high frequency or carrier wave very constant in frequency. In order to receive and detect the energy present in, for example, a single side band of such high frequency energy, it is necessary to introduce some local frequency which may be employed to beat with the side band in order that the low or voice frequency signals may be faithfully reproduced.

A common practice for receiving a high frequency modulated signal is first, to change the frequency of the signal to another frequency lowered in the frequency spectrum, which may be amplified more easily than the first high frequency originally received, and second, to detect the signal from the intermediate frequency. This is done by the well-known means of beating the received high frequency signal with the unmodulated, sinusoidal frequency of a local oscillator to produce an intermediate frequency which can then easily be amplified. One can readily see that the intermediate frequency should vary no more than the higher frequency originally received, if it is essential to maintain high quality standards throughout the system.

In this invention there will be shown, merely for the sake of illustration, an oscillator-detector arrangement which will be connected to an antenna system tuned to receive a side band of high frequency signals in order to change the received band of signals into another and similar band of signals changed in the frequency spectrum. Another oscillator will supply the frequency to beat with the latter band of signals in order to derive the original or low voice frequency signals therefrom. The latter oscillator will have a piezo-electric device connected thereto to carefully adjust the frequency of the oscillations sus-

tained thereby and, besides, to control these oscillations at the particular frequency desired. By beating the band of signals which is changed in the frequency spectrum, with the oscillations sustained by the oscillator which are controlled and varied by means of the piezo-electric device, the low frequency signals originally present in the form of high frequency energy are faithfully detected and reproduced.

Accordingly it is an object of this invention to associate the output of an oscillator with a band of high frequency energy, so that by controlling and varying the frequency of the oscillator as conditions necessitate, the original band of signals will be faithfully reproduced with considerably greater accuracy than has heretofore been possible.

Another of the objects of this invention is to reform a side band of high frequency energy into a corresponding band of signals in a different position in the frequency spectrum and to beat the latter band of signals with the oscillations sustained by an oscillator having a piezo-electric device associated therewith for controlling and varying the frequency thereof in order to reproduce the signals originally present in the side band of high frequency energy, all of which is accomplished with considerably greater accuracy than has heretofore been possible.

While the invention will be pointed out with particularity in the appended claims, the invention itself, both as to its further objects and features, will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing showing one embodiment of the invention, merely for the purpose of illustration.

Referring to the drawing, an antenna system is shown comprising an antenna N and ground, which antenna system is employed to receive a side band of very high frequency energy. This side band of high frequency energy is impressed upon an oscillator-detector OD₁. This oscillator-detector OD₁ generates a high frequency wave which is used to beat with the side band of high frequency signals received by the antenna sys-

tem. Accordingly there will appear in the output of the oscillator-detector OD_1 another band of signals corresponding to the band of signals received by the antenna system but which is changed in the frequency spectrum. It will be understood that this oscillator-detector OD_1 may be of any well-known type, but that it is preferably of the vacuum tube type. The oscillator-detector OD_1 is connected to an intermediate frequency amplifier A which amplifies the band of signals transmitted by the oscillator-detector OD_1 , which, of course, corresponds to the side band of high frequency signals received by the antenna system. After amplification by the intermediate frequency amplifier A, the band of signals transmitted thereby is impressed upon another detector D_2 .

The reference character O designates an oscillator which sustains oscillations of a high frequency. This oscillator may be of any well-known type but it is preferably of a vacuum tube type. This oscillator may also be of the untuned type and may, of itself, vary in frequency considerably from its characteristic frequency. In order to maintain the frequency of the oscillator O constant in frequency within very narrow limits and in order to render the frequency characteristic of the oscillator O adjustable as may be found desirable, a piezo-electric device is associated therewith which device comprises a piezo-electric crystal PE which is placed between two conductive electrodes L_1 and L_2 . The conductive electrode L_1 is preferably rigidly fixed to an adjustable thumb screw T so that as the thumb screw is moved inwardly or outwardly, a corresponding change will take place in the distance between the piezo-electric crystal PE and the conductive electrode L_1 . Obviously, the width of the dielectric, such, for example, as air, between the conductive electrode L_1 and the piezo-electric crystal PE, may be changed by manipulation of the thumb screw T. The piezo-electric device, of course, may be located in a box or other container which may be made of bakelite, hard rubber or other insulating material. Means may also be provided for accurately determining the displacement of the thumb screw T. It is to be understood that it is within the scope of this invention to provide any means whatsoever for rendering a fine adjustment of the space between the piezo-electric crystal PE and one or both of its conductive electrodes so that in effect the frequency characteristic of the piezo-electric crystal may be carefully adjusted and varied with considerable precision.

In an oscillator with which a piezo-electric device is associated, which comprises a piezo-electric crystal vibrating between conductive electrodes, it has been found that the frequency of oscillations sustained by the oscillator may be controlled and varied as

to frequency by adjusting the size of the gap existing between the piezo-electric crystal and its conductive electrodes. Generally, as the space between the crystal and its conductive electrodes changes, a corresponding change is produced in the frequency of the oscillations sustained by the oscillator. More particularly, as the distance between the piezo-electric crystal and its conductive electrodes is increased, the frequency of the oscillations sustained by the oscillator will, under normal conditions, also be increased, and vice versa. This is exactly what takes place when the piezo-electric device, comprising the piezo-electric crystal and the conductive electrodes L_1 and L_2 , is associated with the oscillator O. Briefly, the frequency of the oscillations sustained by the oscillator O may be controlled and varied by the piezo-electric device with precision.

Oscillations sustained by the oscillator O, which are controlled and varied by the piezo-electric device, are also transmitted to the detector D_2 . This detector may be of any well-known type but it is preferably of the vacuum tube type. The frequency of the oscillator, thus controlled and varied, beats with the band of signals amplified and transmitted by the intermediate frequency amplifier A, so that the original signals which were present in the side band of high frequency energy received by the antenna system are accurately detected by the head set R. It will be fairly obvious that if the oscillator O were not controllable and variable as to frequency by a device such as is shown here, i. e., a piezo-electric device, the original signals would not be faithfully reproduced. By associating the piezo-electric device with the oscillator O, it is possible to maintain such a high quality in transmission as has heretofore not been possible.

It will be understood that while this invention has been shown herein for the purpose of illustration as a double detection system, the principles of this invention may be applied to numerous other systems and to various embodiments of such systems without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a signaling system, the combination of means for receiving a side band of high frequency energy characteristic of speech signals, means for producing another band of signals corresponding to the received side band but changed in the frequency spectrum, an oscillator generating a wave to be beaten with the band of signals changed in the frequency spectrum, a piezo-electric structure connected to the oscillator for controlling the frequency of the generated wave, means for varying the vibratory period of the piezo-electric structure so as to correspondingly vary the frequency of the wave generated by

the oscillator, and means for beating the piezo-electrically controlled and varied frequency of the oscillator with the band of signals changed in the frequency spectrum in order to accurately reproduce the speech signals.

2. In a signaling system, the combination of means for receiving a band of signals of high frequency representing voice frequency signals, an oscillator-detector to produce from said band of signals another and similar band of signals changed in the frequency spectrum, an oscillator, a piezo-electric structure including a piezo-electric crystal and two spaced electrodes, said piezo-electric structure being coupled to said oscillator, means including a screw-threaded member for varying the spacing of the electrodes of the piezo-electric structure in order to change the frequency of the current produced by the oscillator coupled thereto, and means for beating the piezo-electrically controlled and varied frequency of the oscillator with the band of signals changed in the frequency spectrum to accurately derive the original voice frequency signals.

In testimony whereof, I have signed my name to this specification this 6th day of October, 1926.

RUSSELL S. OHL.